night rains. During the summer months heavy night rains are more frequent than during spring and autumn. The day rains of summer, however, are but little heavier than day rains of spring and autumn.

As many insurance companies insure against 0.10 inch of rain, Figure 8 is presented, which gives the average number of times each month a rainfall equaling or exceeding 0.10 inch was recorded during the 12-hour periods ending at 7 a. m. and at 7 p. m. for the 19 years 1905 to 1923. During June night rains equaling or exceeding 0.10 inch were recorded an average of 5.2 times. The greatest number of day rains were recorded in May (3.4) and the least in August (1.8). In October day rains of 0.10 inch or more were slightly more frequent than night rains, the average being 2.1 for day rains and 1.9 for night rains.

The records for the 19 years studied indicated clearly that from May to October night rains at Lincoln were uniformly of more frequent occurrence, of longer duration, and of greater intensity than day rains.

a distribution of rain just opposite of what would be expected. The average fall of rain at Topeka from 5 a. m. to 6 a. m. is more than three times as great as from noon to 1 p. m., and this surprising fact is confirmed by the amounts credited to adjacent hours. More than 60 per cent of the average day's precipitation occurs between 6 p. m. and 6 a. m.[1]

This distribution of precipitation becomes an important matter, especially in the summer months, when most outdoor activities take place. Practically everything done outdoors is subject to interruption or delay by rain. Were the wettest hours at Topeka in the afternoon instead of at night, many lines of human endeavor would be more hampered by unseasonable weather than they now are. Fields and the great stretches of unsurfaced highways dry out rapidly in the warm season of the year in the Middle West, and often after a heavy rain at night field work of certain kinds can be resumed the next day and motorists find properly graded dirt roads passable after a few hours sunshine.

TABLE 7.—*Average hourly intensity of rainfall at Lincoln, Nebr. (for the hour ending with those given)*

[Total hourly accumulated divided by number of times rain is recorded during the hour]

Month	A. M.												P. M.												Average
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	
May	0.108	0.043	0.033	0.042	0.045	0.037	0.039	0.022	0.028	0.025	0.025	0.014	0.025	0.038	0.029	0.024	0.035	0.056	0.069	0.046	0.058	0.055	0.055	0.063	0.042
June	.093	.086	.066	.058	.053	.040	.060	.024	.027	.058	.039	.038	.040	.051	.034	.029	.024	.024	.046	.089	.098	.119	.109	.090	.058
July	.070	.132	.058	.050	.067	.039	.038	.059	.062	.053	.048	.060	.028	.026	.037	.035	.080	.105	.149	.088	.101	.159	.074	.086	.071
August	.096	.122	.163	.122	.096	.095	.086	.082	.028	.022	.055	.030	.009	.009	.010	.060	.020	.062	.078	.092	.127	.085	.130	.105	.074
September	.085	.094	.113	.090	.072	.051	.045	.047	.046	.049	.049	.048	.024	.029	.030	.082	.065	.053	.074	.069	.054	.044	.081	.082	.062
October	.031	.025	.044	.028	.030	.023	.019	.017	.015	.024	.021	.039	.025	.030	.026	.030	.035	.033	.030	.018	.037	.043	.028	.029	.028
Mean	.080	.084	.080	.065	.060	.048	.048	.042	.034	.038	.040	.038	.025	.030	.028	.043	.043	.056	.074	.067	.079	.084	.080	.076	.556

TABLE 8.—*Average hourly intensity of rainfall for 6-hour periods at Lincoln, Nebr.*

[Total hourly accumulated divided by number of times rain is recorded during the hour]

Month	Midnight to 6 a. m.	6 a. m. to noon	Noon to 6 p. m.	6 p. m. to midnight
May	0.051	0.026	0.034	0.058
June	.066	.041	.034	.092
July	.069	.053	.052	.110
August	.116	.050	.028	.103
September	.084	.047	.047	.067
October	.030	.022	.030	.031
Mean	.069	.040	0.38	.077

HOURLY PRECIPITATION AT TOPEKA, KANS.

S. D. FLORA, Meteorologist

[Weather Bureau Offices, Topeka, Kans., February 16, 1924]

To a person acquainted with the peculiarities of the climate of the Middle West and, especially eastern Kansas, where three-fourths of the year's moisture falls in the six summer months and is largely the result of thundershowers, it is a surprise to find that the hour with the heaviest fall of moisture is near sunrise, and the one with the least from noon to 1 p. m. This condition prevails at all times of the year, but is most pronounced in the summer season, which is also the thunderstorm season.

Thundershowers are chiefly the result of great upward rushes of air, due to overheating of the layer near the surface of the earth on warm afternoons, and this cause would naturally be less near sunrise, yet the graph shows

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Outdoor gatherings of all kinds, baseball games, picnics, and fairs, depend for their success chiefly on the absence of rain during the afternoon, and this distribution at Topeka has proved peculiarly favorable to them. The growing practice among managers of the more important events to insure against rainfall at specified hours, usually between noon and 6 p. m., has caused a closer study to be made of its distribution through the day, which has been one of the motives in this compilation.

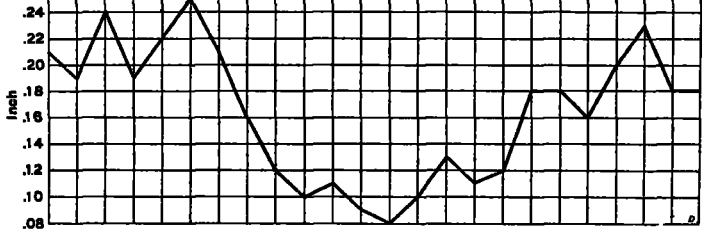

FIG. 1—Average hourly percipitation, Topeka, Kans., April to September, inclusive, for the period 1905–1923

The hourly records of precipitation at Topeka, like those at other Weather Bureau stations of the first order established more than 19 years ago, have been carefully compiled since the use of station Form No. 1014 was begun January 1, 1905. The means in the table that accompanies this article were obtained from this 19 years' record at Topeka. A few discrepancies have resulted in the record of winter months from moisture which fell

[1] Cf. Kincer, J. B. Daytime and nighttime precipitation. MO. WEA. REV., 44: 628–633.

in the form of snow and could not be recorded by the self-registering gauge, as rain has been recorded. In most instances the accumulated hourly amounts of precipitation that fell as snow have been credited to the hours ending 7 a. m. and 7 p. m.—the regular observation hours—with the result that the means for those hours are abnormally high for the winter months. To a less extent accumulated amounts have been credited to the hour ending at midnight, which has caused a slight rise in the mean for that hour. This trouble does not appear in the records for the warm months of the year, May to September, inclusive, and is seen to but a small extent in the records for April and October.

TABLE 1.—*Average hourly precipitation at Topeka, Kans., 1905–1923*

[Inches and hundredths]

Month	A. M.												P. M.											
	1	2	3	4	5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	9	10	11	Midnight
January	0.02	0.01	0.02	0.03	0.02	0.03	0.13	0.02	0.02	0.01	0.02	0.03	0.02	0.01	0.02	0.03	0.02	0.04	0.12	0.03	0.03	0.03	0.04	0.08
February	0.04	0.05	0.02	0.06	0.05	0.04	0.11	0.04	0.03	0.07	0.05	0.07	0.08	0.05	0.04	0.03	0.05	0.08	0.28	0.02	0.04	0.04	0.07	0.11
March	0.08	0.09	0.06	0.07	0.06	0.04	0.19	0.05	0.03	0.05	0.05	0.06	0.04	0.09	0.10	0.08	0.10	0.09	0.19	0.10	0.09	0.12	0.21	0.25
April	0.17	0.11	0.16	0.10	0.09	0.10	0.19	0.12	0.07	0.06	0.06	0.08	0.08	0.05	0.07	0.08	0.12	0.07	0.18	0.09	0.11	0.08	0.12	0.15
May	0.15	0.22	0.25	0.16	0.24	0.27	0.22	0.20	0.12	0.13	0.19	0.13	0.11	0.24	0.15	0.14	0.16	0.13	0.18	0.21	0.26	0.24	0.13	0.15
June	0.18	0.14	0.28	0.23	0.34	0.21	0.14	0.12	0.12	0.16	0.12	0.13	0.08	0.11	0.10	0.10	0.09	0.21	0.28	0.26	0.28	0.26	0.22	0.14
July	0.32	0.30	0.32	0.20	0.16	0.33	0.18	0.09	0.08	0.05	0.05	0.01	0.05	0.10	0.13	0.16	0.18	0.24	0.13	0.08	0.17	0.22	0.21	0.21
August	0.16	0.15	0.22	0.24	0.18	0.34	0.24	0.18	0.08	0.08	0.15	0.06	0.06	0.07	0.09	0.04	0.12	0.25	0.17	0.20	0.25	0.18	0.21	0.21
September	0.30	0.26	0.21	0.21	0.34	0.27	0.28	0.26	0.22	0.14	0.10	0.12	0.08	0.05	0.23	0.13	0.08	0.15	0.11	0.10	0.16	0.41	0.22	0.18
October	0.10	0.11	0.07	0.12	0.19	0.09	0.07	0.10	0.11	0.08	0.07	0.06	0.07	0.10	0.09	0.09	0.08	0.08	0.14	0.11	0.17	0.12	0.10	0.19
November	0.10	0.07	0.08	0.10	0.07	0.04	0.10	0.04	0.02	0.07	0.08	0.03	0.06	0.06	0.09	0.06	0.12	0.13	0.13	0.07	0.06	0.08	0.09	0.12
December	0.01	0.01	0.03	0.04	0.01	0.02	0.11	0.03	0.04	0.04	0.02	0.03	0.02	0.02	0.03	0.06	0.06	0.05	0.15	0.04	0.03	0.03	0.04	0.08
Entire period	0.14	0.13	0.14	0.13	0.15	0.15	0.16	0.10	0.08	0.08	0.08	0.07	0.06	0.08	0.10	0.08	0.10	0.13	0.17	0.11	0.14	0.15	0.14	0.16
April to September, inclusive	0.21	0.19	0.24	0.19	0.22	0.25	0.21	0.16	0.12	0.10	0.11	0.09	0.08	0.10	0.13	0.11	0.12	0.18	0.18	0.16	0.20	0.23	0.18	0.18

THUNDERSTORM AT MEMPHIS, TENN., APRIL 29, 1924

By A. R. LONG, Observer

[Weather Bureau, Memphis, Tenn., May 10, 1924]

The weather map on the morning of April 29 showed an area of low pressure of considerable intensity central over Oklahoma. On the morning of April 30 it was central over the lower Ohio Valley. Numerous thunderstorms occurred on the eastern and southern sides of this low-pressure area.

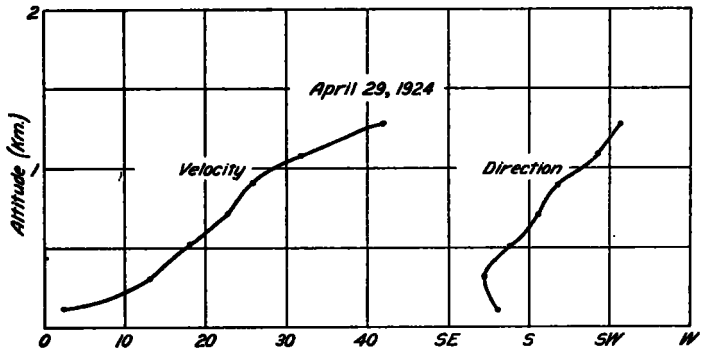

FIG. 1.—Wind velocity and direction just previous to thunderstorm (3:11 p. m.)

A thunderstorm of mild character occurred at Memphis on the morning of April 29. Another thunderstorm occurred during the afternoon, and the following notes are taken from the station records. First thunder heard at 3:20 p. m. and continued at lengthy intervals until 7 p. m. Rain began 3:50 p. m. and ended 7:20 p. m. A trace of hail fell from 4 p. m. until 4:01 p. m. Excessive precipitation began 4 p. m. and ended 4:30 p. m. A maximum wind velocity of 52 miles and an extreme velocity of 64 miles per hour from the northwest occurred at 3:57 p. m.

A peculiar feature of this storm can best be described as a large whirlwind cutting a path about 30 feet wide. It was first noticed on the Arkansas side of the river, where part of a large tree was blown down about 3:55 p. m. Moving from a WNW. direction across the river, it carried spray from the surface of the water spirally upward in a counterclockwise direction to the base of the low-lying clouds. The clouds at this point were very turbulent and moving rapidly from the WNW. In its passage across Wolf River, to the east of and parallel to the Mississippi River, it seemed to disturb the houseboats in its path more than the other houseboats on either side. Several windows were broken out of the Fall Building, situated upon the bluff about 500 feet from Wolf River and in the path of this disturbance, while adjoining buildings on both sides escaped undamaged. Branches were broken off of a number of trees and a few windows broken at several other places in the city, but no serious damage was reported.

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FROST ON THE CRANBERRY BOGS OF NEW JERSEY

By GEORGE S. BLISS, Meteorologist

[Weather Bureau Office, Philadelphia, Pa., January 26, 1924]

The Weather Bureau has studied frost conditions on the cranberry bogs for many years, partly for the purpose of improving the forecasts and effecting greater savings thereby, and partly because of the interesting meteorological problems that the conditions present.

In 1906 and 1907 Prof. Henry J. Cox, of the Chicago station, made an exhaustive study of these conditions on the Wisconsin bogs, and the results were published as Bulletin T, W. B. No. 443. In 1917 Mr. C. A. Donnel spent the fall season at Whitesbog, N. J., and studied the physical conditions, but did not carry his studies far enough to work out any conclusive results.

In the fall of 1921 the Weather Bureau began a series of temperature and humidity observations at Whitesbog, under the supervision of the writer, for the purpose of obtaining data from which to compute a radiation formula (i. e., an equation from which to compute the minimum to which the radiation will carry the temperature during the night) for use in forecasting bog minimum temperatures. The fall series of observations was made